Animal & Plant Health Agency

Regional Six-monthly Report of Descriptive Bovine TB Epidemiology for the Low Risk (Four Yearly Testing) Areas of England

Regional Office:

This report contains bovine tuberculosis (TB) information related to the counties of Cumbria (county number 8), Lancashire (21), Greater Manchester (44) and Merseyside (25), all of which make up the low incidence (4-yearly testing) region of the North West of England.

Year-end report for 2018

1. Cattle Industry in the Region

The low incidence area of the North West of England is formed by four counties and several Metropolitan district local authorities. From a bovine TB point of view and for simplicity, we have divided the region into three geographical areas.

1.1 The county of **Cumbria** has approximately about 3,000 cattle herds, with a similar number of beef and dairy herds. The size of herds is very variable, ranging from smallholdings with one or two animals to large dairy herds with over 1,000 animals per herd.

Compulsory pre-movement TB testing of cattle from higher risk herds was established as a precautionary measure in March 2006 to mitigate the risk of spreading TB through movements of infected cattle from these areas. It currently applies to all cattle of at least 42 days of age that are moved out of herds on an annual or six-monthly testing frequency. In recent years, farmers within the Cumbrian LRA are becoming increasingly aware of the risk of buying cattle from areas of high and intermediate incidence of bovine TB. Thus many herd owners who need to purchase cattle source them locally via livestock markets.

However, there are cattle dealers who bring animals from the higher risk areas of GB to be sold through markets within the county. Purchasers of these animals are not necessarily aware of the origin until after animals have been bought, although they have been pre-movement tested for TB with negative results and, since April 2016, require a post-movement test too. Owners of herds that buy in cattle for final finishing tend to be less cautious of the sources of their purchased cattle, and many of these cattle will be slaughtered prior to completion of their post movement test.

There are twelve livestock markets in Cumbria. There is an important trade of movement of cattle from Cumbria into Scotland.

A substantial number of cattle imports from Northern Ireland and the Republic of Ireland come through the county, generally ending on beef finishing/fattening units. A number of pedigree breeding bulls from Northern Ireland also move onto Cumbrian farms.

Approximately, on average, four to five hundred cattle movements from other parts of England to Cumbria take place every month. APHA carry out tracing tests on cattle moved into Cumbria from herds that are found to be infected with bTB after the cattle movement took place.

Pre-movement testing Exempt Finishing Units (EFUs) are not permitted in the LRA. There are no Licensed Finishing Units (LFUs) currently approved in Cumbria

There are eleven cattle city farms in Cumbria.

1.2 The county of **Lancashire** has approximately 1,770 cattle herds, with a similar number of beef and dairy herds. The size of herds is very variable, ranging from smallholding with 1 or 2 animals to several very large dairy herds with up to 2800 animals per herd.

The larger dairy herds tend to source their dairy replacements, usually in-calf heifers, from Germany and The Netherlands.

In general terms, most breeding herds do not buy in many animals and replacements are often sourced from local areas or via local livestock markets.

Large intensive beef units try to source cattle locally, but often go further afield into high bTB incidence areas, as cattle prices are cheaper in the high risk (endemic) TB areas.

There is currently one LFU in Lancashire. There are four livestock markets in Lancashire and 14 city farms in the county.

1.3 The counties of **Greater Manchester and Merseyside** have a very small population of cattle. Both counties encompass two of the biggest cities of England and their surrounding metropolitan Boroughs. By contrast, the number of equine premises has increased significantly during recent years.

The number of cattle herds in Greater Manchester is approximately 425 and in Merseyside only about 50 cattle herds. Most of the herds are very small holdings, with an average herd size of 30 to 60 animal and little investment in cattle housing, machinery and equipment. There is an approximately 50-50 split between beef and dairy herds.

There is one large finishing unit in Merseyside which sources animals from higher risk areas of GB. Fortunately, this unit is surrounded by urban areas and has no neighbouring cattle farms. Many holdings rarely buy in replacements, as the cattle keepers consider their cattle as non-commercial pet animals.

There are no LFUs or TB Isolation Units in Greater Manchester and Merseyside. Likewise, there are no livestock markets in Greater Manchester and Merseyside.

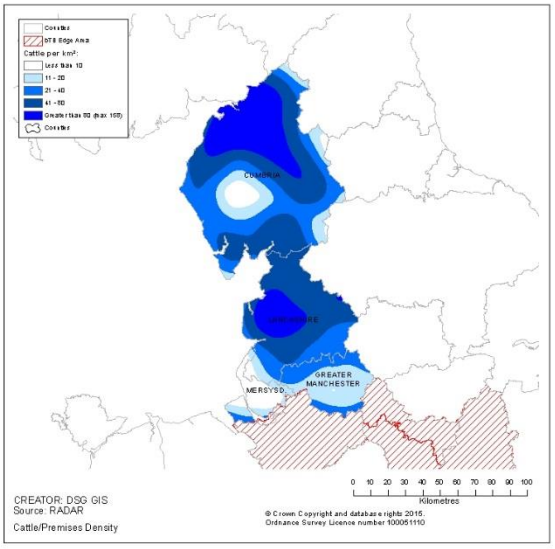
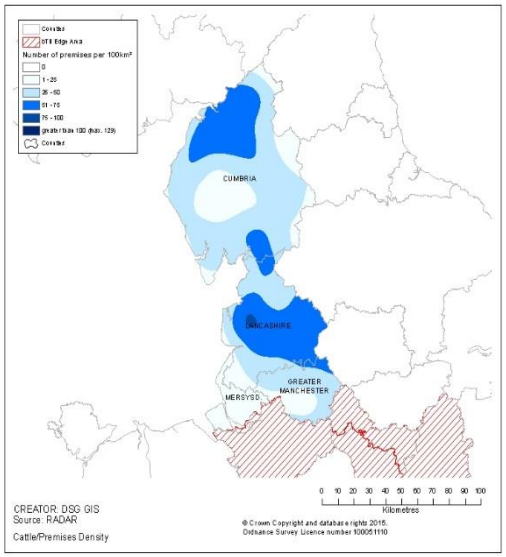
Number of cattle premises by size band in the division at 1 January of the reporting year.

Cattle per premises		0	1 - 50	51 - 100	101 - 200	201 - 350	351 - 500	501+	All	Mean	Median
CUMBRIA	**08**	23	1131	500	587	420	170	150	2981	146	81
LANCASHIRE	**21**	26	831	263	269	197	100	83	1769	129	55
MERSEYSIDE	**25**	1	26	13	6	1	4	2	53	104	48
GREATER MANCHESTER	**44**	6	297	54	45	19	3	1	425	52	21

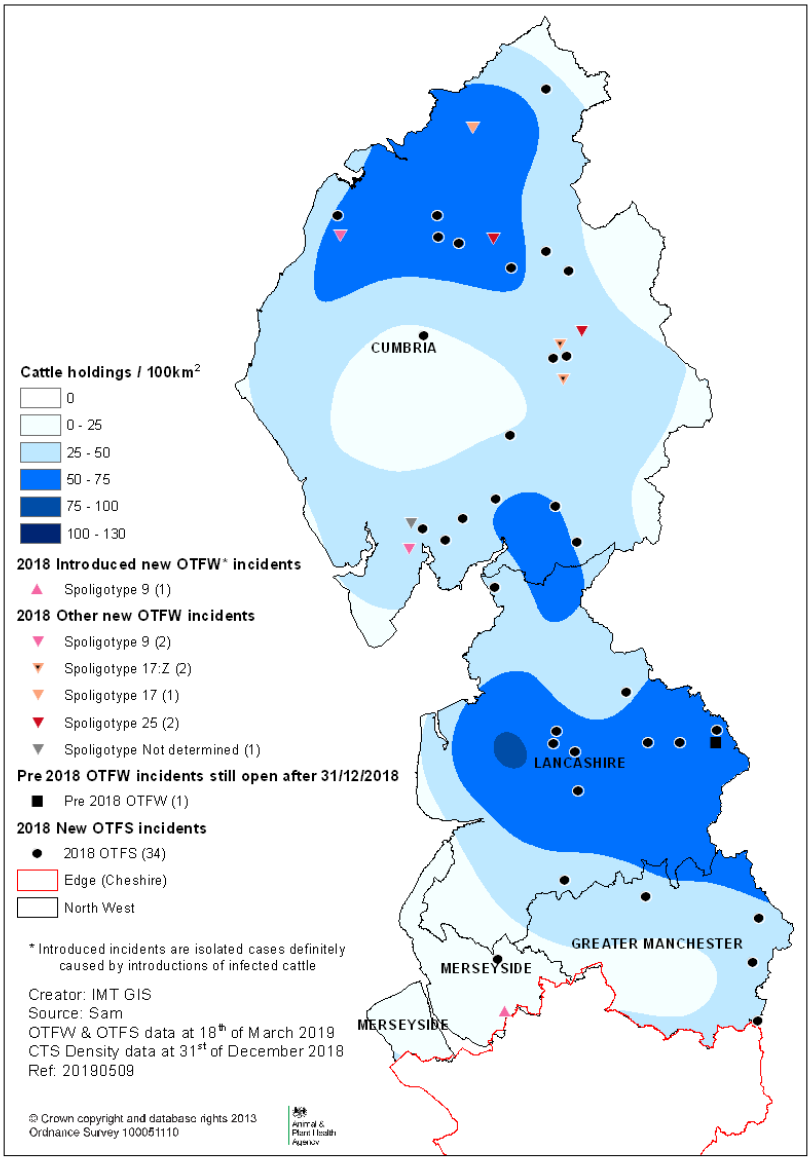
Cattle breed purpose - numbers and percentages at 1 January of the reporting year.

County		**Beef**	**Dairy**	**Dual Breed**	**Unknown**	**Total**
CUMBRIA	**08**	210851 (8.3%)	210720 (8.3%)	14612 (3.3%)	31 (0.0%)	436214
LANCASHIRE	**21**	76527 (33.6%)	138926 (60.9%)	12569 (5.5%)	5 (0.0%)	228027
MERSEYSIDE	**25**	2859 (51.7%)	2519 (45.6%)	149 (2.7%)	0 (0.0%)	5527
GREATER MANCHESTER	**44**	13427 (60.7%)	8138 (36.8%)	545 (2.5%)	20 (0.1%)	22130

Density of cattle and cattle premises at 1 January of the reporting year.

Map - Cattle per square km		Map - Number of premises per 100 square km
		

2. Geographical Distribution of Bovine TB Breakdowns in the Region



3. Summary of the Regional Headline Cattle TB Statistics

There were nine new OTFW breakdowns detected in this part of the LRA uring 2018, along with 34 OTFS breakdowns with only lesion- and culture-negative reactors. Eight of the new OTFW breakdowns involved cattle holdings in Cumbria and there was one new OTFW in Merseyside. There was one OTFW breakdown in Lancashire, but this was the continuation of a case detected in 2017. Greater Manchester had no OTFW cases in 2018. This represents an improvement over the previous year, when a total of 18 new OTFW breakdowns were reported in all these counties of the LRA.

Herd-level statistics	**CUMBRIA**	**LANCASHIRE**	**MERSEYSIDE**	**GTR MANCHESTER**
(a) *Total number of cattle herds live on Sam at the end of the reporting period*	3397	2093	71	480
(b) *Total number of cattle herds subject to annual TB testing at the end of the reporting period (any reason)*	880	163	13	65
(c) *Total number of herd tests carried out in the period*	1969	788	29	257
(d) *Total number of OTF cattle herds TB tested during the period for any reason*	791	482	21	152
(e) *Total number of OTF cattle herds at the end of the report period (i.e. herds not under any type of TB2 restrictions)*	3371	2074	69	465
(f) *Total number of cattle herds that were not under restrictions due to an ongoing TB breakdown at the end of the report period.*	3387	2087	71	478
(g) *Total number of new TB breakdowns detected in cattle herds during the report period*	27	10	2	4
• *OTF status suspended (OTFS)*	19	10	1	4
• *OTF status withdrawn (OTFW)*	8	0	1	0
(h) Of the new OTFW herd breakdowns, how many:				
• occurred in a holding affected by another OTFW breakdown in the previous three years?	0	0	0	0
• could be considered secondary to a primary breakdown based on current evidence?	0	0	0	0
• were triggered by skin test reactors or 2xIRs at routine herd tests?	2	0	0	0
• were triggered by skin test reactors or 2xIRs at other TB test types (forward and back-tracings, contiguous, check tests, etc.)?	4	0	0	0
• were first detected through routine slaughterhouse TB surveillance?	2	0	1	0
(i) Number of new breakdowns revealed by enhanced TB surveillance (radial testing) conducted around those OTFW herds				
• OTFS	0	0	0	0
• OTFW	0	0	0	0
(j) *Number of OTFW herds still open at the end of the period (including any ongoing*	5	0	0	0

OTFW breakdowns that began in a previous quarter)				
(k) New confirmed (positive *M. bovis* culture) incidents in non-bovine species detected during the report period (indicate host species involved)	0	0	0	0
Animal-level statistics (cattle)				
(a) Total number of cattle tested in the period (animal tests)	289146	81606	2286	11521
(b) Reactors detected:	209	19	1	4
• tuberculin skin test	52	19	1	4
• additional IFN-gamma blood test reactors (skin-test negative or IR animals)	157	0	0	0
(c) Reactors per breakdown	8	2	1	1
(d) Reactors per 1000 animal tests	0.72	0.23	0.44	0.35
(e) Additional animals identified for slaughter for TB control reasons (DCs, including any first-time IRs)	9	7	0	0
(f) SLH cases (tuberculous carcases) reported by FSA	10	7	1	4
(g) SLH cases confirmed by culture of *M. bovis*	2	0	1	0

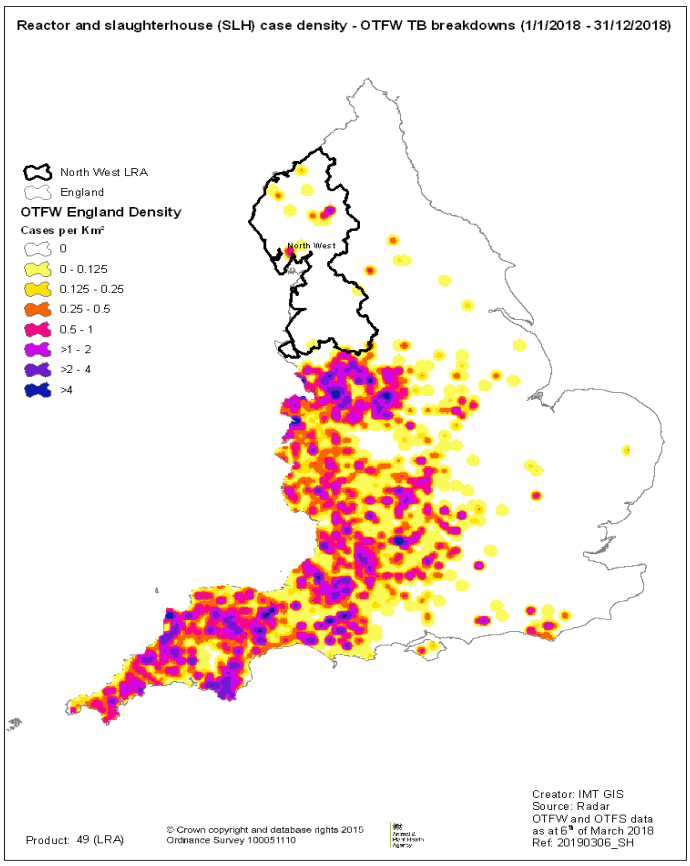
2017 (for comparison purposes)

Herd-level statistics	**CUMBRIA**	**LANCASHIRE**	**MERSEYSIDE**	**GTR MANCHESTER**
(l) *Total number of cattle herds live on Sam at the end of the reporting period*	3476	2125	81	505
(m) *Total number of cattle herds subject to annual TB testing at the end of the reporting period (any reason)*	750	290	11	79
(n) *Total number of herd tests carried out in the period*	1924	856	30	194
(o) *Total number of OTF cattle herds TB tested during the period for any reason*	775	370	22	105
(p) *Total number of OTF cattle herds at the end of the report period (i.e. herds not under any type of TB2 restrictions)*	3410	2092	77	490
(q) *Total number of cattle herds that were not under restrictions due to an ongoing TB breakdown at the end of the report period.*	3426	2109	79	498
(r) *Total number of new TB breakdowns detected in cattle herds during the report period*	33	6	2	5
• *OTF status suspended (OTFS)*	21	3	0	4
• *OTF status withdrawn (OTFW)*	12	3	2	1
(s) Of the new OTFW herd breakdowns, how many:				

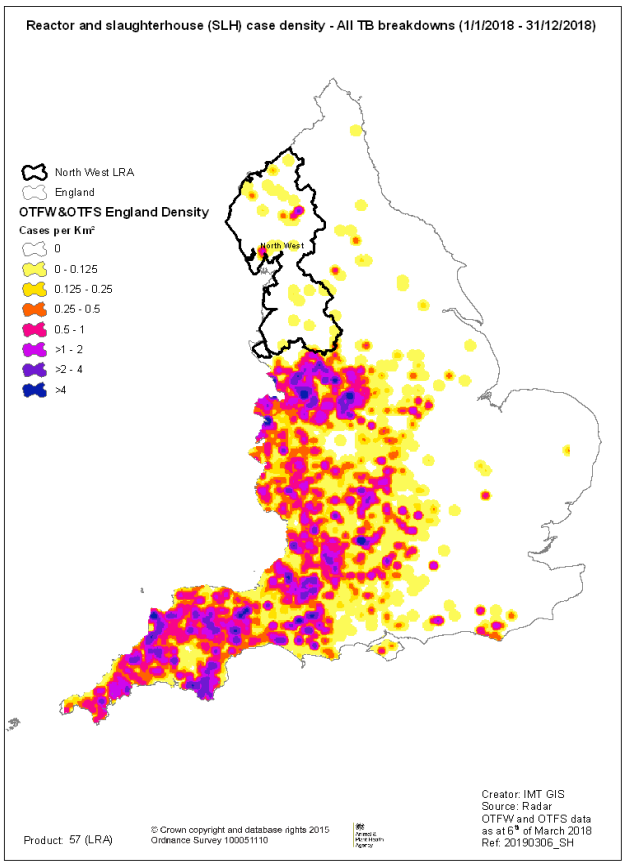
• occurred in a holding affected by another OTFW breakdown in the previous three years?	2	0	0	0
• could be considered secondary to a primary breakdown based on current evidence?	1	0	0	0
• were triggered by skin test reactors or 2xIRs at routine herd tests?	2	1	0	1
• were triggered by skin test reactors or 2xIRs at other TB test types (forward and back-tracings, contiguous, check tests, etc.)?	8	1	1	0
• were first detected through routine slaughterhouse TB surveillance?	2	1*	1	0
(t) Number of new breakdowns revealed by enhanced TB surveillance (radial testing) conducted around those OTFW herds				
• OTFS	8	3	0	1
• OTFW	2	1	0	0
(u) *Number of OTFW herds still open at the end of the period (including any ongoing OTFW breakdowns that began in a previous quarter)*	8	0	0	0
(v) New confirmed (positive *M. bovis* culture) incidents in non-bovine species detected during the report period (indicate host species involved)	4 (3 x badger 1 x deer)	0	0	0
Animal-level statistics (cattle)				
(h) Total number of cattle tested in the period (animal tests)	261,206	97,081	2,689	8,113
(i) Reactors detected:	261	71	10	6
• tuberculin skin test	62	12	6	5
• additional IFN-gamma blood test reactors (skin-test negative or IR animals)	199	59	4	1
(j) Reactors per breakdown	8	12	5	1
(k) Reactors per 1000 animal tests	1	1	4	1
(l) Additional animals identified for slaughter for TB control reasons (DCs, including any first-time IRs)	0	0	0	0
(m) SLH cases (tuberculous carcases) reported by FSA	15	6	2	2
(n) SLH cases confirmed by culture of M. bovis	2	0	1	0

* Lancashire Case disclosed in a Northern Ireland slaughterhouse

Density of TB reactors and slaughterhouse cases in TB breakdowns per km²



Density of skin test reactors, IFN-gamma test reactors and slaughterhouse cases in Officially TB Free Status Withdrawn (OTFW) breakdowns per km² taken in the reporting period



Density of skin test reactors, IFN-gamma test reactors and slaughterhouse cases in OTFW and Officially TB Free Suspended (OTFS) breakdowns per km² taken in the reporting period

4. Suspected Sources of *M. bovis* Infection for all the New OTFW Breakdowns Identified in the Report Period

Most likely origin	Provisional	Final
Introduction (e.g. purchase) of infected animal(s)	1	
Local - lateral spread from neighbouring holdings:	1	
• exposure to infected wildlife e.g. badgers	2	
• other farmed species		
• recrudescence of residual infection from a previous TB breakdown		
• infected human source		
Undetermined/obscure	5	
Other (explain)		

Please attempt to categorise all new OTFW TB breakdowns identified in your region using the following risk matrix, according to (a) the probability of them being the result of introduced infection (inward cattle movements) and (b) the strength of evidence that we are dealing with an isolated incident without further propagation from the index farm to neighbouring herds (or vice versa). Enter the corresponding numbers of breakdowns in the relevant boxes. Any OTFW breakdowns falling in the greyed-in boxes may be removed from the county bTB incidence calculations for the purposes of EU reporting:

		Probability of isolated, sporadic ('one-off') breakdown, without secondary local spread from the index case		
		Likely (no secondary breakdowns detected)	**Possible (no secondary breakdowns detected, but dataset incomplete)**	**Not likely (secondary spread from the index case, or exposure to a common wildlife source has occurred)**
Probability of introduced *M. bovis* infection introduced via cattle movements	**Definite**			
	Likely	1		
	Possible			
	Not likely (indigenous infection in the locality)		5	3

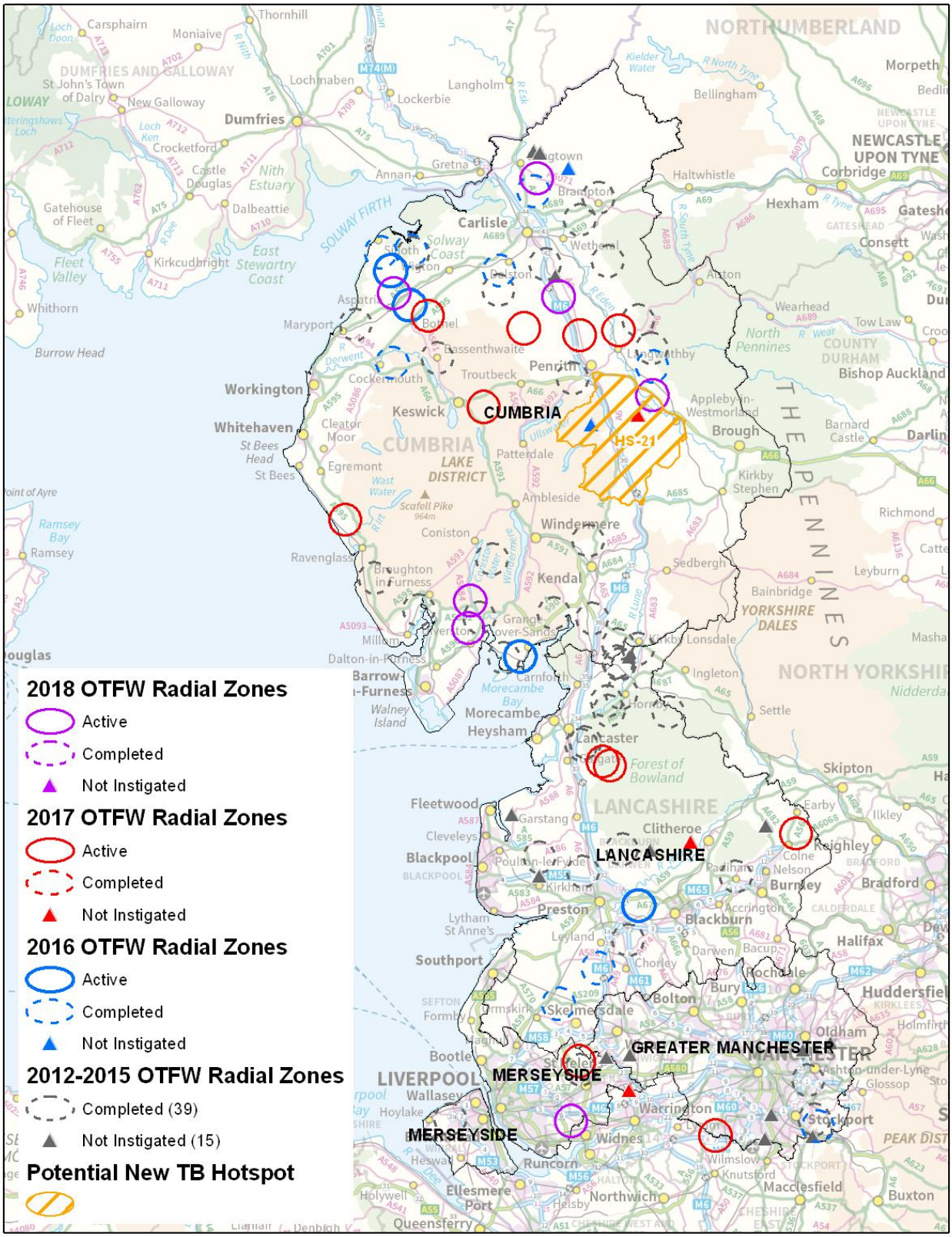
5. Overview of the bTB Eradication Programme in the Region

- The enhanced TB surveillance (radial testing) regime was instigated for all new OTFW breakdowns detected in 2018, with very few exceptions applied (always backed up by a veterinary risk assessment of the index case). Cattle herds in the TB hotspot area of East Cumbria (HS21) have been under an enhanced six-monthly routine TB testing regime since September 2017. These and other bTB surveillance and control measures in force in East Cumbria are covered in section 6 of this report. The map below displays the location of current and completed radial TB testing areas in the Northwest counties of the LRA, along with the HS21 TB hotspot area.

- Since 2006, cattle in annually tested herds in England and Wales (which includes all herds in the HRA and Edge Area and approximately 10% of herds in the Low Risk Area) must have a skin test with negative results in the 60 days before the are moved to other herds. Cattle moved into any part of England from Ireland or Northern Ireland are post-movement tested. These movement controls were strengthened in April 2016 with the introduction of compulsory post-movement testing cattle entering the Low Risk Area of England from other parts of England and Wales.

- Liaison and educational meetings with NFU and local farmers regarding the regional bTB situation and control have been held regularly in Cumbria and in Lancashire.

- Of ongoing concern is the area around Stockport to the east/south east of Manchester. Wildlife is abundant in this area and a road kill badger survey undertaken in 2016 confirmed a significant percentage of *M. bovis*-positive badgers. Genotype 25.a of *M. bovis* is commonly isolated from TB breakdown herds in the adjoining Edge Area of Northeast Cheshire. In 2019 (so not included in this report) we have had an OTFW breakdown in this same area, genotype 25.a.



6. Wildlife

There was one active 'hotspot' area with found dead wildlife surveillance in force in this region within the reporting period. In September 2016, an ad-hoc TB survey of 'found-dead' badgers and wild deer was rolled out across a defined area of East Cumbria (HS21). In 2017, three badger carcases that had been collected from the central area within HS21, were found to be culture positive for *M. bovis* genotype 17:z.

HS-21 East Cumbria (as of mid March 2019):

- Badgers 54 submitted: 3 cultured positive 17.z genotype: 49 cultured negative and two results pending.
- Deer 8 submitted: 8 cultured negative

Update summary report on the cluster of TB herd breakdowns in East Cumbria caused by infection/suspected infection with *M. bovis* genotype 17:z (2014-2018)

A cluster of TB herd breakdowns due to infection with *M. bovis* genotype 17:z has occurred to the southeast of Penrith in central eastern Cumbria. The evolution of this cluster has been reported upon in previous field epidemiology reports for the LRA of the Northwest of England.

Since September 2016, herds of cattle and certain non-bovine livestock species within this area of Cumbria, known as 'Hotspot 21' (HS21), have been subjected to enhanced disease surveillance and control measures over and above the normal regime applicable to radial surveillance zones in the LRA. In September 2016 this additional TB surveillance was extended to encompass carcases of badgers and wild deer found dead (and in the case of deer, also shot) within the designated area. Following the detection in 2017 of *M. bovis* infection in the carcases of three badgers collected in HS21, Defra conducted a public consultation exercise on the principle of TB control measures for badger populations in the LRA. This led to the ministerial decision to authorise farmer-led licensed badger culling in a defined section of HS21, which took place for the first time in the autumn of 2018.

TB breakdowns in the HS21 cluster area, as of end 2018

The index breakdown in cattle was detected in November 2014 and further breakdowns have occurred on holdings with cattle herds within the defined area HS21, or holdings within their 3km radial testing zones, since then until the present time. In the four year period from November 2014 to the end of 2018, this geographic cluster of bTB included **29 breakdowns on 25 separate cattle holdings** (Figures 1 and 2):

- 15 of the 25 affected holdings/herds have had at least one OTFW breakdown (i.e. infection confirmed by culture of *M. bovis* and/or evidence of visible lesions indicative of TB at post mortem examination of test reactors).
- The 15 herds with OTFW breakdowns have been infected with *M bovis* genotype 17:z.
- Recurrent breakdowns have occurred on three of the 25 affected holdings.

A further OTFW breakdown within area HS21, not otherwise mentioned in this summary report, has been confirmed with *M bovis* genotype 25:a and hence appears epidemiologically unrelated to this cluster of genotype17:z breakdowns

At the start of 2018 there were seven breakdowns in the cluster, disclosed during 2017, remaining under TB movement restrictions.

During 2018 a further five breakdowns were disclosed. Four of these were disclosed under the enhanced HS21 herd testing regime, whilst a further one, outwith HS21, was detected at a 3km radial test (from an OTFW genotype17:z breakdown).

At the end of 2018, only two of the herds remained under movement restrictions due to an ongoing TB breakdown.

Figure 1: Temporal distribution, by year, of the 29 new TB herd breakdowns identified in the East Cumbria cluster (area HS21) between 2014 and 2018.

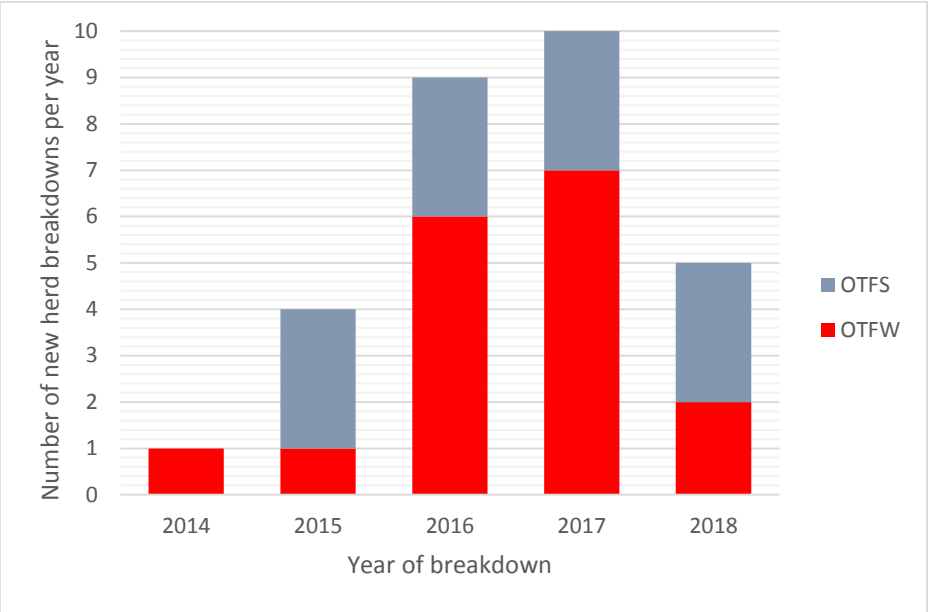
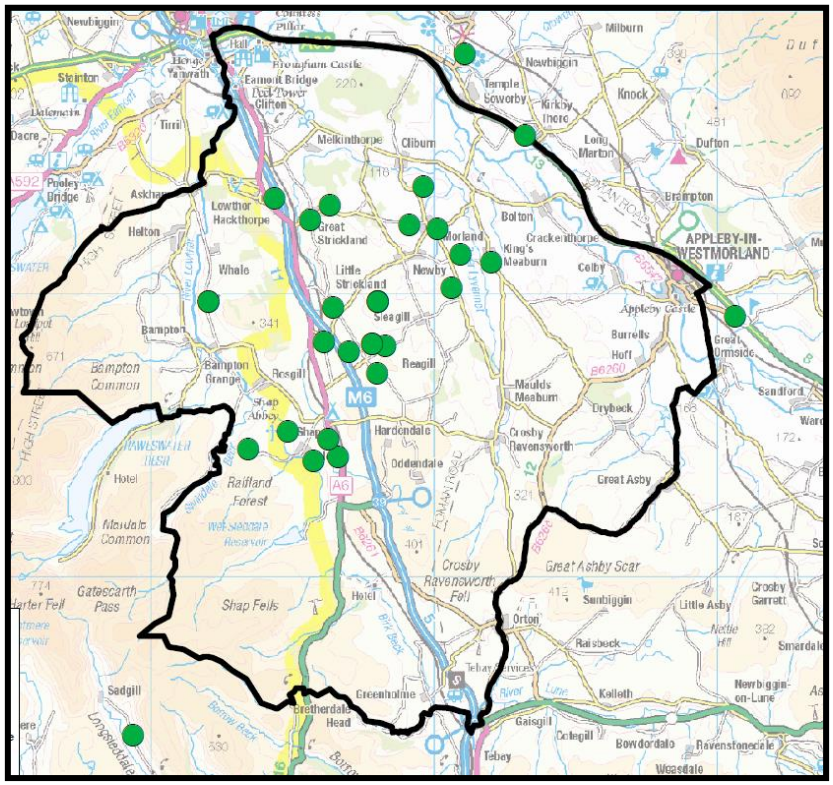


Figure 2: Location of the 26 breakdown holdings 2014- Feb 2019, across the HS21 Area of East Cumbria.



Note: this map shows data up to Feb 2019. These point locations are attributed a steadings of the affected holdings, and do not necessarily denote the most likely locations where the cattle contracted infection.

Enhanced disease control measures across HS21

Since September 2017, additional surveillance and breakdown control measures have been implemented across area HS21 to increase the detection and removal of infected cattle at an early stage. These consist of:

1. Six monthly whole-herd check testing of all cattle herds, with consequential pre-movement testing of all cattle over 42 days moving out of these herds. By the end of 2018, many herds had completed their third six-monthly herd test under this regime (although many had also been under radial zone testing previous to this). Under each round of testing, approximately 30,000 cattle have been tested in approximately 180 herds.
2. Movement restrictions (OTF status suspended) in herds with inconclusive reactors only, pending the 60-day re-test of those animals.
3. Mandatory interferon-gamma blood testing of all the OTFW herds and discretionary blood testing of OTFS breakdown herds.
4. Severe interpretation of skin tests for both OTFW and OTFS breakdown herds.
5. Samples from all cattle with visible lesions of TB at post mortem submitted for culture and genotyping.
6. Ad hoc surveillance of camelid (skin testing followed by serology) and goat (skin testing only) herds.

Badger removal operations in East Cumbria for disease control purposes

In autumn 2018, following licensing by Natural England, badger removal operations were implemented across an epidemiologically defined area of HS21. A total of 602 badgers were removed by the cull company over a seven-week period. Of these, 205 badgers were removed by controlled shooting and 397 as a result of cage trapping.

APHA carried out post mortems and cultured tissue samples from the cage-trapped badgers in an attempt to estimate the prevalence of *M. bovis* infection in this species and supplement the information gathered through testing of badgers found dead within HS21. The cull area in HS21 was split up into an inner 'minimum infected area' (MIA) and an outer cull area around it. Within the MIA, 37 (20.9%) of 177 badgers examined were culture-positive for *M. bovis*, whereas in the outer cull area, three (1.7%) of 173 badgers were culture positive. This gives an overall apparent (minimum) prevalence of infection in badgers of 11% for the whole cull area. All of them were infected with the 17:z genotype of the bacterium previously identified in cattle herds and found-dead badgers in this area.

Publications relating to these disease control operations can be found at:

https://www.gov.uk/government/publications/bovine-tb-summary-of-badger-control-monitoring-during-2018

https://www.gov.uk/government/publications/bovine-tb-surveillance-in-wildlife-in-england/tb-surveillance-in-badgers-during-year-1-badger-control-operations-in-eastern-cumbria-low-risk-area-2018

Molecular epidemiology of the TB cluster in HS21

It has previously been reported that the strain of *M. bovis* responsible for this bTB cluster, genotype 17:z, was most likely imported in cattle from Northern Ireland (NI). Current evidence suggests it most likely that an undetected infected bovine from NI brought this strain of *M. bovis* to GB and then, either that animal itself or a subsequently infected animal, caused the infection in badgers within the HS21. It remains uncertain as to whether the local badgers were infected before or after the first (index) case detected in the area in November 2014. Current evidence suggests that they were most likely infected before, but a medium level of uncertainty is attached to this assessment.

The novel genotype and the closely related whole genome sequences of the *M bovis* isolates in this cluster provide clear evidence that local spread of TB is occurring between cattle and badgers within this part of the LRA. There has been onward spread of TB to other farms inside and outside of HS21 as a result of cattle movements, and amplification of infection within some herds. However, for a number of herds the source transmission pathway is far from clear and acquisition of infection from wildlife (badgers) appears the most likely risk pathway.

Whole genome sequencing (WGS), has been applied to all of the *M. bovis* isolates from cattle and badger in this cluster. This analysis reveals a cluster of 21 differing, but very closely related *M. bovis* sequences. The WGS analysis of the *M. bovis* isolate from the index cattle case shows that this is the earliest common ancestor to all the other isolates, and is identical to an isolate detected within Northern Ireland, indicating that it is highly likely this is the exact strain of *M. bovis* which was imported from Northern Ireland.

This 'ancestral strain' of *M bovis* has been identified in numerous cattle cases in the East Cumbria 17:z cluster from 2014 to 2018, a found dead survey badger in 2017, and numerous culled badgers in 2018. However, despite extensive cattle herd radial testing across the area, it was not identified in any cattle herd breakdowns for a lengthy period from November 2014 until summer 2017. This would appear to suggest that the reservoir of this *M. bovis* strain during this period was in the badger population, rather than locally infected cattle herds.

The high prevalence of *M. bovis* infection in badgers in HS21 indicates that they are a potential source of infection for the local cattle herds and represent a risk for bovine TB persistence in this area. As described above, exceptional disease control measures have been implemented in both cattle herds and the wildlife population in an attempt to control this outbreak within this part of the LRA, distant to the current Edge and High Risk Areas of bTB.

Advice on herd biosecurity and bTB disease prevention, particularly in relation to reducing *M. bovis* transmission between cattle and badgers (and vice versa) has been offered and delivered to farmers by APHA. Local private vets have also been specifically trained by APHA to deliver this advice to their clients.

7. Other Susceptible Species

Nothing to report

Glossary

- bTB – (bovine) Tuberculosis (infection of cattle with *M. bovis*)
- Edge Area (EA) – the annual TB testing area of England situated between the High and Low Risk Areas
- Epidemiology – the science that studies the patterns, causes, and effects of health and disease conditions in defined populations
- Genotype – the genetic makeup of a cell, an organism, or an individual usually with reference to a specific characteristic under consideration
- High Risk Area (HRA) – the annual testing area of England comprising the South West, West Midlands and part of East Sussex, in which *M. bovis* infection is endemic in cattle herds and in badgers
- IFN-γ – interferon-gamma test. A supplementary in vitro blood test for TB used by APHA in conjunction with the tuberculin skin test in some situations, usually to improve the overall diagnostic sensitivity in infected herds with OTF status withdrawn
- Low Risk Area (LRA) – the four-yearly TB testing area of the North and East of England in which *M. bovis* infection occurs only sporadically in cattle and is not considered endemic in wildlife. Although the default testing interval for routine TB surveillance is four years, some higher risk herds in the LRA are subjected to annual testing. There is also more intensive surveillance testing (radial testing) around any herds in the LRA (and parts of the Edge Area) that have their officially TB free status withdrawn due to a TB breakdown
- OTF – Officially Tuberculosis Free status. Herds that are not subjected to TB movement restrictions of any type are classified as OTF
- OTF-S – Officially Tuberculosis Free Suspended status. In England, an OTFS breakdown is a herd in which all the reactors removed had no visible lesions (NVL) on post-mortem examination and had negative culture results for *M. bovis*
- OTF-W – Officially Tuberculosis Free Withdrawn status. In England, an OTFW breakdown is a herd in which at least one test reactor with visible lesions (VL) and/or an animal with *M. bovis*-positive culture result have been disclosed
- Persistent herd breakdown – a herd that has been under TB movement restrictions for 18 months or longer due to infection with *M. bovis*
- Potential ‘Hotspots’ – a temporary area of enhanced TB cattle and wildlife surveillance that may be declared around some OTFW TB breakdowns of uncertain origin detected in a Region of historically low TB incidence
- SIT – short-interval test. A tuberculin skin test of all bovines in a TB breakdown herd, carried out 60 days after the removal of the last test reactor (or laboratory confirmation of a TB slaughterhouse case) in order to restore the OTF herd status. In the majority of cases, two successive SITs with negative results are

necessary. The results can be read using standard or severe interpretation of the skin test. Calves under 42 days old are usually exempted.

- VRA – Veterinary Risk Assessment.